

Science and Technology for National Security

Homeland Infrastructure Assurance

Objective

Argonne's infrastructure research, technology, and assessment program aims to provide expertise and facilities to support the mission of the U.S. Department of Energy and other agencies responsible for assuring the security and reliability of critical U.S. infrastructures and the safety of associated populations.

Approach

Argonne's Infrastructure Assurance Center coordinates Laboratory-wide programs in infrastructure assurance. The Center brings together multidisciplinary teams from across the Laboratory to develop and evaluate cost-effective technologies and methods for detecting, combating, and recovering from chemical, biological, and nuclear terrorism. It seeks to provide effective early warning systems and new methodologies for identifying critical infrastructural components. The Center also develops and applies system models to pinpoint interdependencies and resolve problems that can propagate across linked infrastructures (Figure 1).

The Program

Argonne's program currently includes *vulnerability assessments* focused on physical, operational, and cyber security and the interdependencies of critical infrastructural elements, such as electrical, natural gas, transportation, and telecommunication systems. It considers the potential for cascading impacts resulting from disruptions to one or more types of infrastructure; methods of detecting events affected by interdependencies; and improved technology and procedures for preventing and recovering from such events.

An important component of the program is the *infrastructure outreach* project, which aims to increase the security awareness of infrastructure owners and operators and promote sharing of best practices and lessons learned.

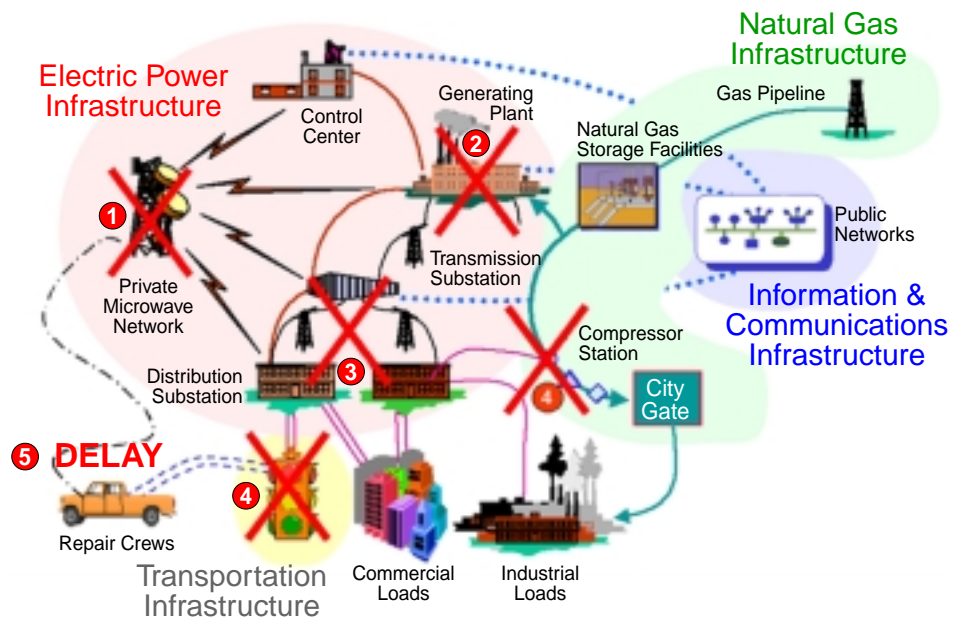


Figure 1. Argonne can analyze cascading and escalating energy system failures.

Through its *community critical infrastructure protection* project, Argonne collaborates with communities and local utilities to develop plans and procedures for municipalities to prevent or recover from major disruptions to energy infrastructure (e.g., natural gas supply systems). The Laboratory recently led a study of the infrastructure interdependencies associated with the attack on the World Trade Center and provided infrastructure assurance support for the Olympic Games in Utah. In partnership with the Commonwealth Edison Company, the City of Chicago, 270 surrounding municipalities, and three pilot communities, Argonne has developed comprehensive guidelines for addressing electric power system disruptions (Figure 2). The guidelines are currently being applied in California, Utah, and other regions. With the Sandia and Livermore national laboratories, Argonne is now demonstrating technologies for mitigating impacts from chemical and biological attacks on interior infrastructures deemed to be at high risk, such as subways, airports, and public buildings.

Models, Tools, and Databases Developed to Support Infrastructure Assurance

- **Emergency Response Synchronization Matrix**
Provides a means to articulate, coordinate, integrate, and synchronize a community's emergency response.
- **Integrated Performance Evaluation System**
Assesses a community's ability to select and carry out appropriate responses to emergency conditions.
- **Emergency Planner for Special Populations**
Accommodates emergency planning for special populations, such as the disabled, who cannot protect themselves from hazards.
- **Electric Power Infrastructure Analysis Tools**
Analyze critical links in the electric power system under normal and stressed conditions. Include information for every generating station in the U.S. power grid.
- **Natural Gas Infrastructure Analysis Tools**
Include a comprehensive information system for analyzing the U.S. natural gas transmission system. Comprise all major system assets. Provide gas flow and impact-analysis tools to assess effects of disruptions.
- **Petroleum Infrastructure Analysis Tools**
Analyze critical assets for production and delivery of petroleum fuels, including refineries, pipelines, tankers and barges, fuel piers, pumping stations, storage terminals, distribution terminals, and units used to monitor and control these facilities.
- **Water Infrastructure Analysis Tools**
Identify threats, vulnerabilities, and mitigation measures for threatened water supply systems.
- **Military Logistics Infrastructure Analysis Tools**
Simulate loading and unloading operations at seaports, military installations, and terminals and identify critical bottlenecks and vulnerabilities.

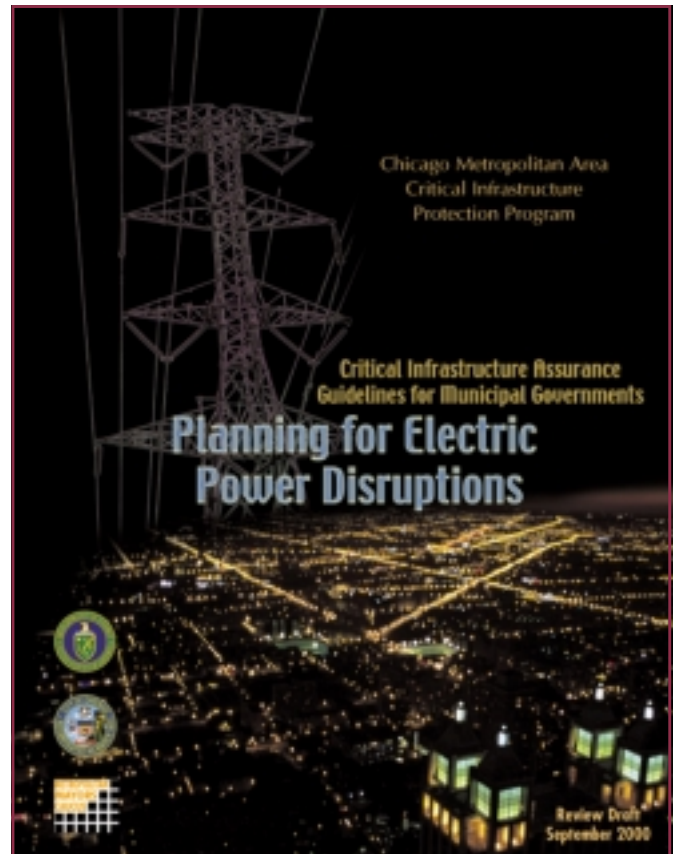


Figure 2. Argonne has developed comprehensive guidelines for addressing electric power system disruptions, a pilot for the nation.

- **Infrastructure Interdependencies Analysis Tools**
Measure the health of the energy infrastructure under normal, stressed, and restoration conditions; identify critical links; examine impacts of concurrent events; analyze how disruptions to one infrastructure affect another; and estimate restoration times and the economic impacts of disruptions.
- **Agent-Based Simulation of Terrorist Networks**
Simulate socioeconomic, psychological, environmental, and other factors to support countermeasures analysis.

Sponsors

U.S. Departments of Energy, Defense,
Transportation, and Agriculture
Defense Threat Reduction Agency
Federal Emergency Management Agency
U.S. Environmental Protection Agency
Defense Advanced Research Projects Agency

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